Comparison of Trophy and Traditional Rainbow Trout Fisheries on Whitetail and Whitewater Lakes in Southeastern British Columbia

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COMPARISON OF TROPHY AND TRADITIONAL RAINBOW TROUT FISHERIES ON WHITETAIL AND WHITESWAN LAKES IN SOUTHEASTERN BRITISH COLUMBIA

by

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ABSTRACT

Martin, A. D. and E. A. Parkinson. 1984. Comparison of trophy and traditional rainbow trout fisheries on Whitetail and Whiteswan lakes in southeastern British Columbia. B. C. Ministry of Environment. Fisheries Mgmt. Rept. No. 79. 15 p.

Trophy regulations were successful in increasing the catch (kill and release) per unit effort and size of fish in comparison with a control lake. The kill rate was, however, only one-third of that on the control lake. Total effort/ha was similar on the two lakes despite a winter closure on the trophy lake. An additional benefit of trophy regulations is that stocking rates can be reduced. In this case, stocking rates on the control lake were three times those on the trophy lake. Anglers on the trophy lake were generally more skilled but active anglers, as opposed to purist and novice anglers, predominated on both lakes.

ACKNOWLEDGEMENTS

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INTRODUCTION

Size limits and quota restrictions have often been used to prevent the overharvest of naturally reproducing stocks of fish. More recently, it has been recognized that restrictive regulations are needed to preserve the quality of a sports fishery (Wydoski 1977). Trout populations in lakes supported entirely by hatchery production cannot be overfished in the classical sense in that no spawning escapement is required. Increased angling pressure can, however, result in situations where CPUE and fish size are so depressed that the quality of the angling experience suffers. In extreme cases, fish may be removed so rapidly that much of the lake's productive capacity for fish may go unutilized despite continued planting of hatchery trout.

Angling pressure in B. C. has doubled between 1960 and 1980 and average CPUE has declined from 4 fish/day to 2 fish/day (Narver 1981). Special trophy lakes, in which restrictive regulations are used to reduce harvest and therefore increase CPUE and the size of fish, are one response to the increasing demand for sports fishing. There is some concern, however, that institution of trophy fisheries will result in reduced angler use and the creation of an elitest fishery for those few anglers who will tolerate restrictive regulations.

This paper outlines the angler use and harvest on Whitetail Lake, a trophy lake, and compares these angling statistics with those on Whiteswan Lake, a nearby non-trophy lake with no special regulations. Whitetail Lake was stocked with the late maturing Duncan stock of rainbow instead of the early maturing Premier strain which was stocked in Whiteswan Lake, in order to reduce the mortality and growth loss associated with the maturation of sublegally sized fish.

STUDY AREA

Whitetail Lake is situated 24 km west of Canal Flats in the Purcell Mountain Range (Fig. 1). The lake was rehabilitated in 1978 with the use of rotenone. Prior to this date a significant fishery did not exist in spite of satisfactory physical chemical characteristics (Table 1) and annual planting of rainbow, cutthroat or brook trout over a large range of stocking rates. Poor survival was attributed to competition with whitefish and longnose dace.

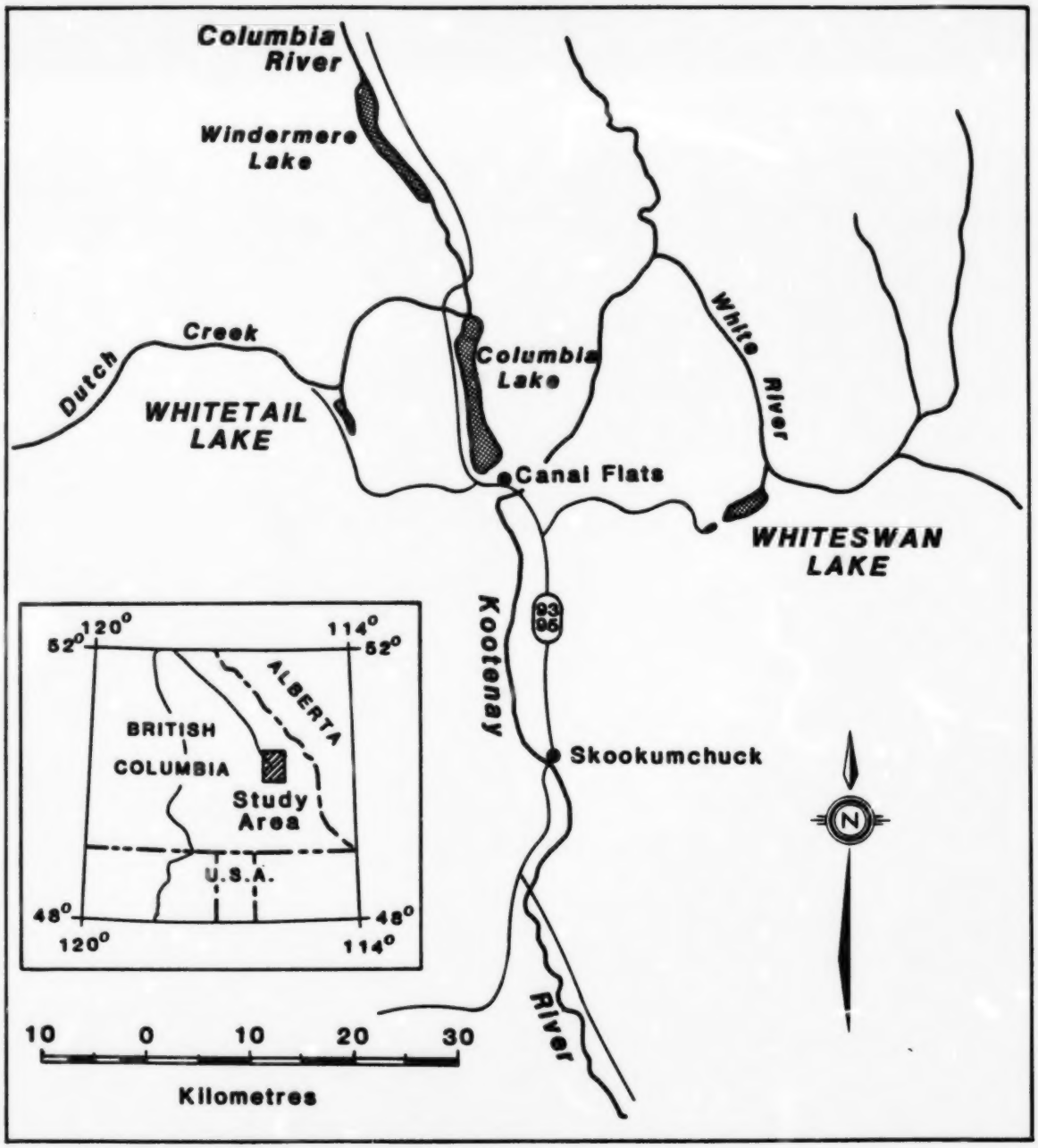

Fig. 1. Location of Whitetail and Whiteswan lakes.

Table 1. Some physical and chemical characteristics of Whitetail and Whiteswan lakes. Theoretical stocking rates are calculated using the method of Stringer et al. 1980.

	Whitetail Lake (trophy)	Whiteswan Lake (non-trophy)
Elevation (m)	1,113	1,160
Surface (ha)	162	433
Littoral Area (ha)	91.9	199
Proportion Shoal Area (m)	.57	.46
Mean Depth (m)	9.8	14
Total Dissolved Solids (mg/l)	215	207
Theoretical Stocking Rate (yearlings)	84,100	183,733

An accelerated fisheries program initiated by the B. C. Fish and Wildlife Branch in 1978 provided funding for the rehabilitation of Whitetail Lake. Following rehabilitation the stock origin and stocking rates of rainbow trout liberated into Whitetail Lake were designed to maintain a population containing a large proportion of trophy trout. Late maturing (5-6 years) Duncan rainbow were stocked into the lake at approximately 1/8 of the normal (Stringer et al., 1980) stocking rates. Trout production in the lake is totally dependent on hatchery stocking.

The Whitetail Lake fishery was initially opened for two months in the spring of 1980; since then, a season of May 1 until September 30 has been established. The daily and possession limit in 1981 was two fish greater than 40 cm; a single hook gear restriction was instituted on the lake in 1981, and a bait ban in 1982. No organized campsite or boat launching facility exists on the lake. Recreation on the lake is primarily day use.

The non-trophy lake used as a control in this study was Whiteswan Lake which is situated in the westernmost ranges of the Rocky Mountains, 20 km east of Canal Flats (Fig. 1). The main differences in the physical and chemical characteristics of the two lakes are the much greater size and slightly larger proportion of shoal area in the non-trophy lake (Table 1).

Chemical treatment of Whiteswan Lake with toxaphene in 1961 removed coarse fish species from the system. The lake has supported a rainbow trout monoculture since 1964. Natural production in the lakes tributary streams has been supplemented by annual plantings of yearling Premier stock rainbow from Wardner Trout Hatchery.

A spawning channel was constructed between Alces and Whiteswan lakes in 1977 and extended in 1982 under the Habitat Conservation Fund with the intent of eliminating hatchery stocking. Natural production of trout occurs in two tributaries in addition to the spawning channel.

Whiteswan Lake supports a year-round fishery, supporting 10,000-15,000 angler days of recreating with catches historically varying from 10,000 to 15,000 fish per year. Angler harvest tends to be split fairly evenly between the summer and winter fisheries. There are no size, gear or bait restrictions on Whiteswan Lake. The daily limit is four (4) fish, possession limit is eight (8) fish.

The lake lies within the boundaries of Whiteswan Lake Provincial Park. Campsite facilities (approximately 100 sites), and boat launching ramps have been constructed by the Parks Branch. Overnight use of the park predominates during the summer.

STOCK ORIGINS

Whitetail Lake was stocked with Duncan-Premier hybrid and pure Duncan rainbow (Table 2). Duncan rainbow were originally from Kootenay Lake. This lake contains a race of large rainbow trout referred to as "Gerrard stock" (Hartman 1969) which are considered to be distinct from other rainbow in the system. Most of these fish spawned in a short section of the Lardeau River system at the outlet of Trout Lake, some fish utilized the section of the Duncan River at the outlet of Duncan Lake (Cartwright 1961). In 1969 and 1970 after the construction of a dam at the outlet of Duncan Lake, a number of these large fish were trapped for fish culture purposes in the Duncan River near its confluence with the Lardeau River. These fish were brooded in the hatchery system and referred to as Duncan rainbow. They are believed to be identical to Gerrard stock rainbow (Andrusak, pers. comm.). Aspects of their life history, reproductive biology, management research and enhancement have been discussed in detail by Cartwright (1961), Hartman (1969) and Irvine (1978).

Table 2. Recent stocking history of Whitetail (trophy) and Whiteswan (non-trophy) lakes rainbow trout 1971-1982.

	Whitetail Lake	Whiteswan Lake
1971	35,000 Premier (Yearlings)	50,000 Premier (Yearlings)*
1972	50,000 Premier (Yearlings)	57,500 Premier (Yearlings)*
1973	55,000 Premier (Yearlings)	80,000 Premier (Yearlings)*
1974	40,000 Premier (Yearlings)	65,000 Premier (Yearlings)*
1975		60,000 Premier (Yearlings)*
1976		70,000 Premier (Yearlings)*
1977		45,000 Premier (Yearlings)*
1978	Lake Rehabilitation	30,000 Premier (Yearlings)*
1979	6,900 Duncan/Premier Cross (2-year olds)	30,000 Premier (Yearlings)*
1980	9,800 Duncan/Premier Cross (Yearlings)	40,000 Premier (Yearlings)*
	20,000 Duncan (Fall Fry)	
1981	9,835 Duncan (Yearlings)	28,000 Premier (Yearlings)
1982	10,000 Duncan (Yearlings)	40,000 Premier (Yearlings)

*Fish marked with adipose - maxillary clip

Whiteswan Lake was stocked with Premier stock rainbow which are an early maturing (2-3 years) strain of rainbow trout from Premier Lake. This system was poisoned with Toxaphene in 1961. Hatchery records indicate that, following rehabilitation, the lake was stocked for six years with both native (Pennask, Swalwell and Knoff) and domestic stocks (McLeary) of rainbow trout after which the lake was used as a brood lake for Kootenay Trout Hatchery. Premier rainbow were used to restock the lake on an annual basis. Whiteswan contains marginal spawning habitat and the maintenance of the fish population is dependent on the annual stocking of 65,000 yearlings. In recent years, improvements to spawning habitat have meant that this supplement has been reduced to about 40,000 yearlings.

METHODS

A creel census was conducted on both lakes from May to the end of September 1982 using a stratified sampling procedure. The days of the month were stratified into the following day classes: Saturdays, Sundays, Mondays and Weekdays. Five check days per month were selected "randomly" with the provision that two weekdays and one Saturday, Sunday and Monday day classes were selected. Both lakes were sampled on the same dates.

The creel census clerks interviewed anglers while they were angling and/or at the end of the anglers' day. Statistics collected were: number of anglers, number of fish caught, number of fish caught and released on Whitetail Lake, and the angler's place of residence. Lengths of the catch were recorded and scale samples were collected.

Monthly estimates for total catch, effort and angling success were extrapolated by multiplying the number of days in each day class per month by the day class sample (i.e. if five (5) Saturdays per month 5 X results from Saturday day class sample).

A 70 percent efficiency was estimated in terms of interviewing effort and catch on the lake. The lake systems are relatively small and it is possible to interview most of the anglers. The final estimates of effort and catch are adjusted to 100 percent.

Scale analysis were separated into groups by length frequency analysis (Peterson Method). A subsample of scales were selected from each group. The scales were mounted on plastic slides and viewed using a M.R.C. Microm 100 microfiche viewer. The scales were aged by counting the number of annular rings.

RESULTS

Angler Effort and Success

Whitetail Lake supported 11,301 rod hours of angling by 3,485 anglers resulting in a catch of 5958 and a kill of 966 trophy rainbow from May 1 to September 30, 1982. The average catch per unit effort (CPUE) was .09 fish per rod hour for trophy fish, .52 for released fish. The mean size of fish retained was 44.5 cm (n = 144). Over the same period Whiteswan Lake supported 15,881 rod hours of angling resulting in a kill of 3,553 fish.

The average catch per unit effort was .22 fish per rod hour. The mean size of fish captured was 35.7 cm (n = 423). Approximately ten percent of fish caught on Whiteswan Lake are released by anglers.

Angling effort was greatest during the month of June on Whitetail Lake, declining steadily in July, August and September, compared to Whiteswan Lake where angling effort peaked in August (Table 3).

Table 3. Creel census results for Whiteswan (trophy) and Whitetail (non-trophy) Lakes, May to September, 1982.

	Anglers	Rod Hours	Catch (Released)	Retained Catch Per Rod Hour	Retained Catch Per Rod Hour
MAY					
Whitetail	765	2,317	139 (2455)	.06	.39
Whiteswan	477	1,820	247	.14	
JUNE					
Whitetail	758	3,681	302 (1244)	.08	.34
Whiteswan	923	3,981	710	.18	
JULY					
Whitetail	772	1,934	196 (687)	.10	.35
Whiteswan	871	2,864	721	.25	
AUGUST					
Whitetail	938	2,266	205 (559)	.09	.35
Whiteswan	1,404	4,813	1,157	.24	
SEPTEMBER					
Whitetail	252	1,104	124 (1013)	.11	.91
Whiteswan	672	2,404	718	.30	
TOTAL					
Whitetail	3,485	11,301	966 (5958)	.08	.52
Whiteswan	4,347	15,881	3,553 355*	.22	.02

*estimated number of fish released at 10% release rate.

The trend in CPUE was varied between lakes; however, the highest CPUE occurred in September on both lakes. Resident fishermen comprised 84% of the anglers on Whitetail Lake and 81% on Whiteswan Lake. Nonresidents were primarily Albertans. Less than 4% of anglers at Whiteswan and 1.2% at Whitetail resided in provinces other than Alberta or the United States. The occurrence of nonresident anglers was generally highest in June on Whitetail and May on Whiteswan (Table 4).

Table 4. Residence status of anglers on Whitetail (trophy) and Whiteswan (non-trophy) lakes, May - September 1982.

	Resident		Nonresident	
	Number	Percent	Number	Percent
MAY				
Whitetail	132	94	9	06
Whiteswan	43	68	20	32
JUNE				
Whitetail	107	86	18	14
Whiteswan	120	91	12	09
JULY				
Whitetail	68	83	14	17
Whiteswan	62	83	13	17
AUGUST				
Whitetail	86	75	28	25
Whiteswan	89	71	36	29
SEPTEMBER				
Whitetail	23	79	6	21
Whiteswan	54	90	6	10
TOTAL				
Whitetail	496	84	77	16
Whiteswan	368	81	87	19

Size and Age of Capture

The size of rainbow trout kept at Whitetail Lake ranges from 40 to 63 cm fork length with an average size of 44.5 cm. On Whiteswan Lake the size of rainbow kept ranged from 17.5 to 56 cm fork length with an average size of 35.2 cm length. Trout are larger at a given age in Whitetail Lake (Table 5). The age distributions of the catch at Whitetail Lake are dominated by 3+ fish while 3+ and 4+ dominate in the catch at Whiteswan Lake (Fig. 2).

Table 5. Mean fork length (cm) by age of rainbow trout caught from Whitetail (trophy) and Whiteswan (non-trophy) lakes, May - September, 1982.

Age	Fork Length	S. Dev.	N.
Whitetail			
2+	37.6	1.15	3
3+	47.4	4.8	31
4+	Missing	Year Class	
5+	59.2	4.9	7
Whiteswan			
1+	22		1
2+	30.3	3.04	6
3+	33.6	2.56	13
4+	42.4	2.25	12
5+	46.3	1.61	3

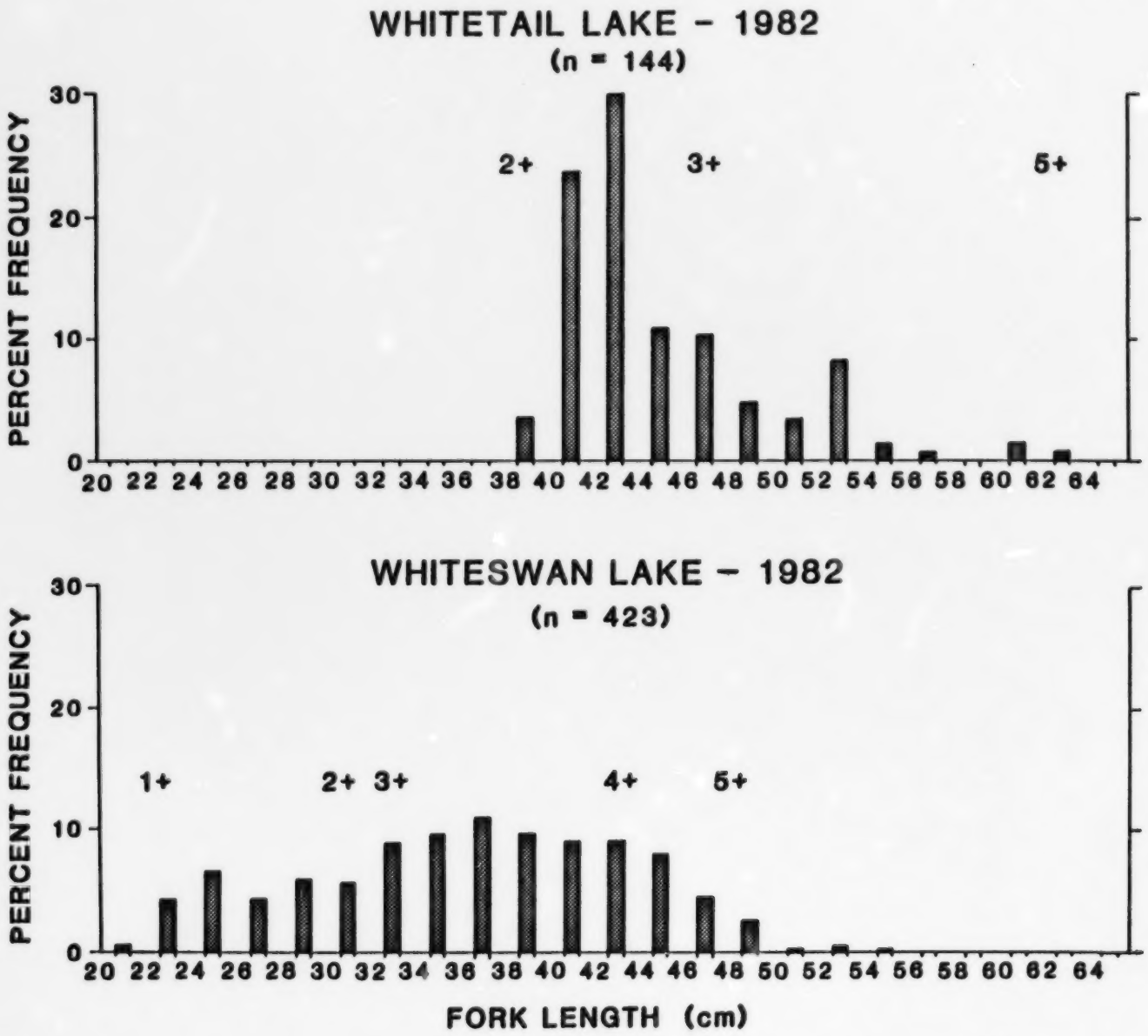

Fig. 2. Percent length frequency and age distribution of rainbow trout from Whitetail and Whiteswan lakes, May - September, 1982.

DISCUSSION

Angler acceptance of the Whitetail Lake trophy rainbow fishery has been favorable in spite of the restrictive size limits, gear restrictions, a two fish catch quota, and low success rates for legal fish. The catch success rate for killed and released fish combined at Whitetail Lake is approximately three times the success rate for the traditional rainbow fishery at Whiteswan Lake. The higher than average success rates and the opportunity to catch larger than average sized fish undoubtedly contributes to the popularity of the trophy fishery.

The difference in success rates between the two lakes are not only a reflection of the management of the lakes but also the angler types they attract and their relative skills. Classified according to a system developed by Clawson (1965), active anglers are the dominant angler type at both lake systems. The more skilled purist anglers utilize both lakes but they only form a large proportion of anglers at Whitetail Lake. Most of the nonresident effort on the lake is by this angler type. Participation by less skilled incidental anglers is high at Whiteswan Lake as a consequence of its setting in a provincial park. They do not fish Whitetail Lake extensively probably because of its restrictive regulations.

The Whitetail Lake fishery supported 11,300 rod hours of recreation from May to September compared to 15,900 rod hours at Whiteswan Lake. Although total angling effort was less on the trophy lake, effort per hectare was twice that of the non-trophy lake over the summer. On an annual basis, effort per hectare was similar on the two lakes due to the presence of a winter fishery on the non-trophy lake which was absent on the trophy lake.

The effects of trophy regulations on yields may not be determined from Whitetail Lake as a consequence of the incomplete age structure of trout and post-rehabilitation effects. Fish in lakes that have been recently rehabilitated temporarily have higher growth and survival rates. This effect is probably due primarily to increased fish food availability resulting from the fallow period between rehabilitation and restocking, and a lack of fish predators on invertebrate fauna and reduced competition between age classes for the initial years of stocking. This effect is similar to, but not as dramatic as the result of stocking a barren lake.

The stocking rates for Whitetail and Whiteswan lakes (natural recruitment included) are 13 and 44% of the theoretical stocking rates (Stringer et al. 1980). The theoretical stocking formula is a function of TDS, shoal area and total area. Given the TDS of the two lakes are approximately equal, the stocking

rate of Whitetail is approximately 1/3 of Whiteswan Lake on a per unit area basis, where shoal area is weighted 10X surface area. The trophy regulations appear to generate considerably more effort and success (killed and released) per fish stocked. This is critical in light of the limited availability of special stocks and the limited supply of hatchery fish.

Duncan rainbow were selected for introduction into the trophy lake because of their relatively late age of maturation (6+) compared to other native stocks used by provincial hatchery system. This characteristic is very desirable, particularly for trophy fisheries because the late maturing stocks remain in the fishery for a greater length of time and grow to a larger size prior to maturation. The late maturation of Duncan rainbow increases the length of time from when a stock recruits into the fishery (generally in the fall following stocking as yearlings to maturation in productive interior lakes) from approx 2 years with stocks such as Premier to approx 4 years. The initial summer's growth of both Premier and Gerrard stock rainbow introduced in equal numbers in productive small lakes near Cranbrook was similar in the first summer (Fish and Wildlife Branch unpublished data). Duncan rainbow in Whitetail Lake attain much larger sizes by age than Premier stock in Whiteswan; however, the relative contribution of the stock differences in size at age between the fish in the two lakes is confounded by stocking density and post rehabilitation effects.

The size limit on the trophy lake resulted in larger fish to the creel in spite of the absence of the 4+ age class which, if present, would have been larger than average. The fishery was based primarily on the 3+ age class with minor contributions from the 5+ age class (initial stocking after rehab) and the 2+ age class which was only partially recruited into the legal fishery. The incomplete age structure resulted in a higher ratio of legal to undersized fish being captured than should be the case in the future.

A high mortality of undersized fish was reported in 1981 when anglers were permitted to use bait. In 1982, a bait ban was instituted and creel census clerks noted a sharp drop in the number of dead, undersized fish observed in the lake. In a review of the literature Wydoski (1977) found that hooking mortality associated with the use of bait averages 25% (range 3.3-61.5%) and is much higher than that of flies and lures which average 4% (0.11-3% range) and 6% (1-42 range), respectively.

It is probable that some hooking mortality is associated with Duncan stock rainbow. Duncan stock rainbow had high post-hooking mortalities in studies conducted by Facchin (1983) and Cartwright (pers. comm.) where mortality of fly-caught fish

was 35% and 50%, respectively. The mortality rate is well above the average and upper range limit summarized for this gear type by Wydoski (1977) and suggested by observations of the Whitetail Lake fishery. The discrepancy in hooking morality rates may be as a result of one or a combination of the following factors. Fish introduced into Whitetail Lake for the first two years were Duncan-Premier hybrid rainbow. These fish may have lower post-hooking mortality characteristics than pure Duncan stock rainbow. Post-hooking mortality may increase with the size of fish. The fish caught and released in the Whitetail Lake fishery are smaller (> 40 cm) than those used in the study by Facchin (1983) (47.8 cm). Finally, it is possible the post-hooking mortality estimate for Whitetail Lake may have been underestimated.

The effect of trophy regulation on Whitetail Lake suggests that the results are similar to what occurs on streams. Although the proportion of fish killed drops dramatically, the total catch standing crop and average size of fish is increased (Hunt 1981; Moore et al. 1979; Lewensky and Bjornn 1982). Effort in stream fisheries either shows a moderate drop (e.g. 29%, Moore et al. 1979) or remains about the same (Hunt 1981) compared to effort prior to the trophy fishery. A pre- and post- comparison of effort at Whitetail Lake is not valid as the increase in the abundance and size of fish are also a function of increased production through the elimination of coarse fish and the use of special stocks, as well as the effects of trophy regulations. The comparison with Whiteswan Lake, however, indicates no significant differences in effort/ha between the trophy and non-trophy lakes averaged over the year.

The key elements in producing a trophy sized fish are productive lakes, light stocking rates, and late maturing stocks. The regulation of trophy fisheries are dependent on size limits to maintain a large sized fish, low bag limits to reduce harvest, and gear restrictions to minimize post-hooking mortality. The initial results from the Whitetail Lake trophy fishery are encouraging. The full potential of the fishery in terms of both angler use and harvest has probably not been utilized. Trophy fisheries are a viable management option for small lake management in the province. They are capable of supporting substantial angling pressure with reduced stocking rates and at the same time increase the variety of angling opportunities and experience. Trophy fisheries are utilized primarily by the purist and active angler and are not as attractive to incidental anglers. As a result, it should be developed only in areas where there are a number of alternative lake systems to provide angling opportunities to all types of fishermen.

RECOMMENDATIONS

1. The Whitetail Lake creel census should be continued to:

   a) Determine the levels of effort and catch once the age structure of the rainbow trout population is complete and the effects of the lake rehabilitation have worn off.

   b) Examine the post-hooking mortality of illegal 40 cm rainbow trout and estimate the effects on recruitment of fish into the trophy fishery.

2. The Fish and Wildlife Branch should continue research to identify or produce a late maturing rainbow trout stock with good fighting qualities that has low post-hooking mortalities suitable for release and no-kill fisheries.

3. The Fish and Wildlife Branch should continue research on the stocking formula (Stringer et al. 1980). The stocking formula may overestimate the numbers of fish required for stocking particularly in recently rehabilitated systems. This is important in light of the limited supply of wild fish and the cost of producing fish in the provincial hatchery system.

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